University of Bahrain

College of Information Technology
Department of Computer Science

ITCS252 Discrete Structures

First Semester 2013/2014

Exam #1 – 60 Minutes

STUDENT NAME	
STUDENT#	
SECTION	

This exam contains 4 pages (including this cover page) and 6 questions. Check to see if any pages are missing. Enter all requested information on the top of this page, and put your initials on the top of every page, in case the pages become separated.

You *are not allowed* to use books, notes, mobiles, or any calculator.

Question	Points	Score
1	6	
2	6	
3	8	
4	6	
5	6	
6	8	
Total:	40	

Instructor: Dr. Ali Alsaffar Sections# 1 & 4
Dr. Yousif Al-Jazeeri Sections# 2 & 3 & 5 (Coordinator)

(1) **[6 points]** Show that $(\neg p \vee \neg q) \wedge q \rightarrow \neg p$ is a tautology.

(2) **[6 points]** Let h : "I am professional", m : "I have a degree", and g :"I have experience". Convert the following into symbolic form.

▷ I have neither a degree nor experience. $\neg(m \vee g) \equiv \neg m \wedge \neg g$

▷ I am not professional unless I have a degree and experience. $\neg(m \wedge g) \rightarrow \neg h$

▷ I am not professional if I have a degree but not experience. $m \wedge \neg g \rightarrow \neg h$

(3) **[8 points]** Let $P(x, y)$: "x plays with y".

Express the following statements in symbolic form using *only* the predicate $P(x, y)$. The domain is L, the set of all children.

▷ MAZEN Plays with all children

$\forall x \in L : P(Mazen, x)$

▷ Some children play with *JALAL* and *NAWAL*

$\exists x \in L : P(x, JALAL) \wedge P(x, NAWAL)$

▷ All children do not play with some children

$\forall x \in L, \exists y \in L : \neg P(x, y)$

▷ No children play with SINBAD

$\neg \exists x \in L : P(x, SINBAD) \equiv \forall x \in L : \neg P(x, SINBAD)$

(4) [6 points] Assume the domain $D = \{6, 1, 2\}$, find the truth values. Justify your answer.

(a) $\exists x \in D : \; x^2 - 1 = 0$

☑ True ☐ False

Example: $x = 1$

$\therefore \; 1^2 - 1 = 0$

(b) $\forall x \in D, \exists y \in D : \; \frac{2x}{y} = 1$

☐ True ☑ False

Solve for $y \Rightarrow y = 2x$ ($y \in D$, $2x \notin D$)

Counter example: $x = 6 \Rightarrow y = 2 \times 6 = 12 \notin D$.

(c) $\exists y \in D, \forall x \in D : \; x + 1 > y$

☑ True ☐ False

Example: $y = 1 \Rightarrow 1 < 7, 1 < 2, 1 < 3$

(5) [6 points] Use *Truth Tables* to determine whether the following argument is valid or not.

$$\begin{array}{l} p \rightarrow q \\ \underline{p \rightarrow \neg q} \\ \therefore p \end{array}$$

(6) [**8 points**] Consider the following argument.

> *The red ball is under the first cup or it is not under the third cup. If the red ball is not under the second cup or it is under the fourth cup then the red ball is not under the first cup. The red ball is under the third cup but it is not under the fifth cup. Therefore, the red ball is under the second cup.*

(a) Translate the argument into symbolic form.

$C_1 \vee \neg C_3$

$\neg C_2 \vee C_4 \rightarrow \neg C_1$

$C_3 \wedge \neg C_5$

$\therefore C_2$

(b) Prove that the argument is valid

1) $C_3 \wedge \neg C_5$

$\therefore C_3 \;/\; \therefore \neg C_5$

2) $C_1 \vee \neg C_3$

C_3

$\therefore C_1$

3) $\neg C_2 \vee C_4 \rightarrow \neg C_1$

C_1

$\therefore C_2 \wedge \neg C_4$

4) $C_2 \wedge \neg C_4$

$\therefore C_2$